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AUTHOR(S):

Chavtur, Vladimir G.

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Morphology and Systematics of the ostracod *Euconchoecia* (Myodocopa: Halocyprididae) from the North-Western Pacific

VLADIMIR G. CHAVTUR

A.V. Zhirmunsky Institute of Marine Biology, Far East Branch, Russian Academy of Sciences,
Vladivostok 690041, Russia
Far Eastern Federal University, Vladivostok 690050, Russia
E-mail: vchavtur@gmail.com

Abstract The North-Western Pacific species *Euconchoecia pacifica* is redescribed, and the status of currently known members of the genus reviewed. This review suggests that the genus includes 21 species. Nine of these have been previously described in the literature, two more were originally described as subspecies, but herein are raised to full specific rank. It is also evident from the literature that at least a further seven species have been miss-attributed to the known species. These latter ten species have only been partially described, and so have been left in open nomenclature. For the North-Western Pacific 14 species of the genus *Euconchoecia* are noted. A key to all these species is presented.

Keywords: pelagic ostracods; Halocyprididae; *Euconchoecia*; taxonomy, North Pacific

Introduction

Pelagic ostracods of the genus *Euconchoecia* Müller, 1890 inhabit the tropical and subtropical zones of the World Ocean predominantly occurring in the upper surface layers. Currently seven species and two subspecies have been attributed to this genus. However, studying our collections and the literature has shown that the genus needs substantial revision. First we redescribe *E. pacifica* and illustrate this species in detail. We revise the genus to include 21 species (Table 1). In addition to the nine extant species, two forms previously considered to be subspecies (*E. chierchiae aspicula* Deevey, 1982 and *E. bifurcata pax* Kornicker, 1989) are raised to full specific rank. A further seven species are left in open nomenclature and three species are as “affinis” for two known species. These have clearly been incorrectly attributed to other species. However, the reports of these species have been accompanied by descriptions and illustrations that while they are detailed enough to reject the original identifications, they are too inadequate to be definitive descriptions of new species.

In the North-Western Pacific we note 14 species of the genus *Euconchoecia*, three of which are described below. The key to all these species and list the list characteristics that distinguish them one from one another.

MORPHOLOGY AND SYSTEMATICS OF *EUCONCHOECIA*

Table 1. Systematic position of ostracods in genus *Euconchoecia* Müller, 1890

Literary date	Proposed system
1. <i>E. chierchiae chierchiae</i> Müller, 1890	1. <i>E. chierchiae</i> Müller, 1890
	2. <i>E. species</i> 1 [= <i>E. chierchiae</i> Müller, 1891 <i>sensu</i> Tseng, 1969, 1980]
2. <i>E. chierchiae aspicula</i> Deevey, 1982	3. <i>E. aspicula</i> Deevey, 1982
3. <i>E. aculeata</i> (Scott, 1894)	4. <i>E. aculeata</i> (Scott, 1894)
	5. <i>E. species</i> 2 [= <i>E. aculeata</i> (Scott, 1894) <i>sensu</i> Müller, 1906]
	6. <i>E. species</i> 3 [= <i>E. aculeata</i> (Scott, 1894) <i>sensu</i> Tseng, 1969, 1980; Chen, Lin, 1995]
	7. <i>E. species</i> 4 [= <i>E. aculeata</i> (Scott, 1894) <i>sensu</i> Chen et al., 1983]
	8. <i>E. aff. aculeata sensu</i> Angel et Graves, 2013
4. <i>E. elongata</i> Müller, 1906	9. <i>E. elongata</i> Müller, 1906
	10. <i>E. species</i> 5 [= <i>E. elongata</i> Müller, 1906 <i>sensu</i> Tseng, 1969, 1980; Chen, Lin, 1995]
	11. <i>E. aff. elongata</i> A Angel et Graves, 2013
	12. <i>E. aff. elongata</i> B Angel et Graves, 2013
5. <i>E. bifurcata bifurcata</i> Chen, 1985	13. <i>E. bifurcata</i> Chen, 1985
	14. <i>E. species</i> 6 – herein
6. <i>E. bifurcata pax</i> Kornicker, 1989	15. <i>E. pax</i> Kornicker, 1989
7. <i>E. shengwai</i> Tseng, 1969	16. <i>E. shengwai</i> Tseng, 1969
8. <i>E. maimai</i> Tseng, 1969	17. <i>E. maimai</i> Tseng, 1969
	18. <i>E. species</i> 7 [= <i>E. maimai</i> Tseng, 1969 <i>sensu</i> Chen, Lin, 1995]
	19. <i>E. pacifica</i> Chavtur, 1976
	20. <i>E. omanensis</i> Graves, 2011
	21. <i>E. hormusensis</i> Graves, 2011

The following abbreviations are used in the illustrations:

- r.sh – Rod sharpened organ
- 1–6 – first–sixth segments of the first antenna
- a–e – terminal setae of the first antenna
- pr – protopodite
- ep – epipodite
- bas – basale
- ex – exopodite
- en, en1, en2, en3 – endopodite, first–third segments on endopodite of the second antenna, maxilla, mandible, fifth and sixth limbs
- ep.p – epipodial plate on the fifth and sixth limbs
- cx – coxale
- prcx – precoxale
- c.e – cutting edge on the coxale of the mandible
- d.tl – distal tooth-list on the coxale of the mandible
- p.tl – posterior tooth-list on the coxale of the mandible
- m.p. – masticatory pad on the coxale of the mandible
- e.b – endite on the basale of the mandible
- I, II – first and second endites on the fifth limb
- ho – hook on the endopodite of the second antenna
- c.ap – copulatory appendage
- c.fu – caudal furca

Taxonomy

Order HALOCYPRIDA Dana, 1853

Suborder Halocypridina Dana, 1853

Superfamily Halocypridoidea Dana, 1853

Family Halocyprididae Dana, 1853

Subfamily Euconchoecinae Poulsen, 1969

Genus *Euconchoecia* Müller, 18901. *Euconchoecia pacifica* Chavtur, 1976

(Figs. 1–5)

Euconchoecia pacifica Chavtur, 1976: 100–104, Figs. 2–4; Chavtur, 1977: 20 (list)*Euconchoecia maimai*: Tseng, 1969 *sensu* Chavtur, 1991: 43; 1992: Table 2 (part)

Holotype: adult female, length 1.55 mm, valves in alcohol and appendages mounted on slides; reference number N2772 (ex N17665) in collection of the Museum of Institute of Marine Biology, Vladivostok, Russia (together with paratype).

Type locality: 33°40'N, 138°12'E; depth: 0–100 m; net: 0.1m² Juday net; date 14 May 1967.

Paratype: adult male, length 1.55 mm, valves in alcohol, appendages mounted on slides; reference number N2773 in collection of the Museum of Institute of Marine Biology, Vladivostok, Russia. From same sample as the holotype.

Table 2. Records of *Euconchoecia pacifica*. All specimens were collected using a Juday Net, except that from Vityaz Stn 6151 which were collected using a 1m² Bogorov-Rass Net. *indicates specimens that have subsequently been lost.

Material studied				
RV	Date	Depth m	Position	Material
Orlyk	29/5/67	0–100	31°30'N 149°00'E	N2775 ♀ 1.54 mm
SRT 662	16/7/53	0–200	35°14'N 152°07'E	N2774 ♂ 1.60 mm
Vityaz Cr 39	29/6/69	0–50	37°38.6'N 143°51.5'E	N2776 ♀ 1.55 mm
Additional material				
SRT 662	11/7/53	50–100	39°21'N 152°07'E	2♀s damaged
SRT 662	16/7/53	50–100	35°14'N 152°07'E	Juv. 1.2 mm
SRT 662	16/7/53	50–100	35°14'N 152°07'E	A-1 ♀ 1.38 mm
Vityaz Cr 19	29/6/54	32–60	40°03'N 143°18.8'E	Juv. 1.1 mm
Vityaz Cr 19	29/6/54	58–120	40°03'N 143°18.8'E	Juv. 1.2 mm
Vityaz Cr 20	2/5/55	150–1000	37°39.8'N 144°30.1'E	2♂s 1.55, 1.60 mm*
Vityaz Cr 20	3/5/55	200–500	37°18.2'N 145°16.2'E	♀ 1.58; juv.*
Orlyk	30/4/67	0–100	37°00'N 149°00'E	♀ 1.55 mm
Orlyk	15/5/67	0–100	33°40'N 138°12'E	♀ 1.60; Juv. 1.22 mm*
Orlyk	29/5/67	0–100	31°30'N 149°00'E	a-1 ♀ 1.38 mm 2 juvs. *
Izumrud	16/6/69	0–100	37°20'N 134°30'E	4♀damaged
Vityaz Cr 39	29/6/69	0–50	37°38.6'N 143°51.5'E	3♀s 1.52–1.55 mm

Redescription of adult male

Carapace (Fig. 1A, B). Length 1.55–1.60 mm. Height is ~50% of length. The carapace is moderately elongate, with maximum height just anterior to the midpoint, so the anterior half of the shell is marginally larger than the posterior half. The ventral margin curves smoothly from below the rostral incisure to the posterior dorsal corner. The posterior margin forms an angle of about 90° with the dorsal margin. The postero-dorsal corners in both valves are rounded and lack spines. The rostrum points almost straight; it is rather broad and symmetrical. The shoulder vault is moderately developed and rounded. Surface of the carapace has no perceptible sculpture and no hairs. Each valve has a gland opening just ventral to postero-dorsal corner. Valves are thin.

Rod-sharped organ (Fig. 1C) is slim with a rounded tip. It is shorter than the first antenna reaching about as far as distal end of the second segment.

First antenna (Fig. 1C). The first segment has disto-ventrally rather developed, verruciform, rounded process. The fifth segment ventrally bears 23–25 sensory filaments, which are about half as long as the limb. The a-seta is about 75% length of the second segment. The b-seta is about 75% length of the rod-sharped organ and somewhat shorter than the sensory filaments. The d-seta is about 3½ times the length of the second segment. The e-seta is longest, slightly widened and flattened distally and about 1.5 times the length of the limb.

Second antenna (Fig. 1D–H). The exopodite is about 70% the length of the protopodite. The first exopodite segment is about twice the combined length of the other eight segments, which carry the long setae with natatory hairs. The natatory setae are subequal to the protopodite. On the endopodite the "a" and "b" setae on the first segment comparatively short, weak and bare. The "b" seta is about 1½ times the length of the "a" seta and is more than half the length of the second segment. The dorsal surface of the first segment has a covering of short fine hairs. The elongate second segment is half the length of the first segment and is broadest near its midpoint. The right endopodite is terminally rounded with a very developed sclerotized bulge, whereas the left endopodite has a slight chitined knob. The longest terminal seta on the right endopodite is about 3 times the length of the protopodite and 3½ times the length of the other terminal seta. The third segment on the left endopodite is prolonged with somewhat thickened base; its dorsal seta is very short and its ventral seta is about half the length of its longest seta. This segment on the right endopodite forms a moderately slender and elongated V-shaped process, which ends in a broadly rounded tip with subterminal ridges. The distal angle of V-shaped process bears 3 filament-like setae, similar to those on same segment of the left endopodite.

Mandible (Fig. 2A). The tooth edge of the coxale has 10 moderately large, simple, smooth, triangular teeth, the second of which (from anterior margin) is considerably larger than the others. The distal tooth-list is only slightly narrower than the tooth edge, and is furnished with 12 teeth, of which the posterior two are very large, tusk-like and smooth; the more anterior one from the others teeth is the largest. The proximal tooth-list, which is very narrow, only a third of the width of the distal tooth-list, consists of 6 smooth teeth ranging in size from moderately large to small. The masticatory pad is very large, the same width as the distal tooth-list. It is simple, with an almost straight distal cutting margin and is armed with very close, short, fine spines. Somewhat proximally of the masticatory pad is a large cavity which has a sharp, raised edge, and which on its inner posterior edge has a dense row of 9 smooth, simple, lancet-like bristles of moderate size. The distal edge of the basal endite bears 6 teeth of about the same width; most of them are serrated; anterior tooth is rather low. There is lateral triangular and serrated tooth. On the posterior end of this edge are two processes, the more anterior one is a very short and bare tube-bristle, and the posterior one is dagger-shaped and furnished with more or less powerful secondary tooth. The basal endite bears two short and two moderately long setae. The epipodial appendage is well developed and bears very long seta, which sparsely hairy and is about as long as the anterior side of the two proximal endopodite segments. The exopodite is represented by a single plumose seta, which is about as long as a half of the endopodite. The first segment of the endopodite has antero-distally

a very short, bare seta and posteriorly three setae with short, fine hairs; these setae are differ in length, but are all are shorter than the segment. The second segment bears antero-distally one long (about half the length of the endopodite and about 65-70% the length of the main terminal claw-like seta), stout seta armed with spines, and another moderately long seta with short hairs. The posterior side of its segment has one short seta furnished with short, fine hairs. There are seven terminal setae on this segment, the third of which (counting from the front) is very powerful, coarsely spinose and claw-like; it is about 75% or somewhat more than the length of the endopodite and about $3\frac{1}{2}$ times the length of its third segment. The most anterior of the terminal seta is similarly spinose and about 65–70% the length of the main claw-like seta.

Maxilla (Fig. 2B–F). The endite on the precoxale bears 7 bristles, of which the inner anterior one and the two outermost posterior ones are tube-bristles. The endite on the coxale is armed with 14 bristles, 6 on the anterior process and 8 on the posterior process. Each process carries 2 tube-like bristles. The basale has a single short seta, which extends well short of the distal boundary of the first endopodite segment. Along the anterior edge of the first endopodite is a row of 5 long setae of differing length; the longest being longer than the segment, the shortest as long as its width. All these setae have short and fine hairs. This segment also carries a few rows of long hairs. There are three more unequal setae on the posterior face of the first segment; the longest seta is as long as the width of the segment. There is also an inner seta on this segment is displaced posteriorly, and is situated close to three posterior setae. This inner seta is subequal in length to the basale seta. The terminal segment is comparatively short, only about half the breadth of the first endopodite segment and fairly stout. It bears six terminal setae, the most posterior of which is strong, long, subequal to the length of the first endopodite segment and about twice as long as the second segment. The most anterior is stout and is fused with segment (there is no suture) and its length is about half the width of the segment. The anterior face of this terminal segment is covered with long hairs.

Fifth limb (Fig. 2G, H). The epipodial plate has 5, 4 and 5 (one short) in the distal, middle and proximal groups respectively. The first endite of precoxale has two setae, the proximal one of which is a short and armed with short hairs, the other is plumose and about as long as breadth of this segment. The second endite bears three setae, two of which are similar in type and length as the short seta on the first endite, the third is similar in type but somewhat shorter than the longer seta on the first segment. The coxale bears eight setae. Two of these, are inserted close to the protopodite, one proximally on the anterior side of the process close to the protopodite, the other ventrally near the exopodite, are of the same type and of similar length as the long setae on the endites of the protopodite. The others setae have short hairs, and differ in length, two of these, which are inserted disto-ventrally on the process, are rather powerful. The basal segment has five ventral setae of different lengths with short hairs and laterally two long plumose setae inserted near the middle of the segment. The ventral and dorsal surfaces of this segment are hirsute proximally. The exopodite is represented by very long seta with fine hairs. The first segment of endopodite bears two ventral and one dorsal setae of moderate length with short fine hairs. The second segment has three terminal setae, the middle one is finely pectinate and powerful being somewhat longer than endopodite. The other two terminal setae are shorter and weaker and are lined with short and fine hairs.

Sixth limb (Fig. 2I, J). It is large and powerful. The epipodial plate has 5, 5 and 7 (one short) setae in the distal, middle and proximal groups respectively. The protopodite bear two disto-ventral subequal setae with short, fine hairs. These setae are as long as or slightly shorter than the width of the protopodite. The basal segment is provided with five setae scattered along the ventral side and somewhat medially similar to the two on the endopodite. These setae are about as long as or slightly shorter than height of this segment. Laterally at about the middle point of the segment there is another seta of the same type, which is about the same length as the shortest ventral seta. There are also a number of rather long soft hairs distributed on the ventral surface of this segment. The exopodite is represented by short seta with short, fine hairs. It is about as long as the height of following segment. The first segment of endopodite has only two ventral subequal setae, which are about half or slightly less the length of the segment. The second segment has two ventral and one dorso-distal seta, all of which carry short hairs. These setae are about as long as or somewhat shorter than its segment. There are

three similar setae on the third segment, which are subequal, plumose and about as long as or slightly longer than the endopodite.

Copulatory appendage (Fig. 3A, B). This is relatively long, slightly curved upward and with small protuberance at the tip. It narrows close to its base, but then broadens to its maximum width at midlength. The ratio between the appendage's length (i.e. from its tip to its minimum width) and the distance between the bases of the first and seventh pairs of caudal furca claws is about 1.7:1. The organ has 7–11 oblique muscle bands.

Caudal furca (Fig. 3A, B). Each lamella bears seven slender claws, and an unpaired bristle is present. On each lamella between the insertions of the first and second claws is a small process. The ratio between the length of the first claw and the height of the furca (i.e., the distance between the insertions of the first and seventh claws) is about 1.5:1.

Redescription of adult female

Carapace (Fig. 3D, E). It shows some sexual dimorphism from that of the male. The length ranges from 1.55 to 1.60 mm. Its height is about 50% of its length. The rostrum is somewhat straighter and postero-ventral margin somewhat more oblique than in the male. The shoulder vault is less distinct. The surface of the carapace has faintly striated.

Frontal organ (Fig. 3F). It is similar to the male's and reaches to about the midpoint of the third segment of the first antenna.

First antenna (Fig. 3F). It has no disto-ventral process on the first segment. There are 23 ventral setae on the fifth segment, which are three-quarters the length of the limb.

Second antenna (Fig. 3G–I). The lengths of the protopodite and exopodite are relatively shorter than in the male, but the ratio between their lengths is similar. The endopodite is also smaller. The setae on the first endopodite segment are similar in type and length to those in the male. The second segment is about a third the length of the first segment. The fused third segment bears one long seta, which is about as long as or slightly shorter than the overall length of the endopodite.

Mandible (Fig. 4A–F). There is only minor sexual dimorphism, with only differences in the sizes of some setae. The main claw on the terminal segment in female it is somewhat longer and about as long as the exopodite. The seta on the second exopodite segment is also longer in the female - about two-thirds the length of the exopodite.

Maxilla (Fig. 4G–I). Very similar to the male's differing only in the number of setae on the coxal endite, which has only five setae on the anterior process and five on the posterior process.

Fifth limb (Fig. 5A–C). Similar in female to the male.

Sixth limb (Fig. 5D). In the female this is a considerably smaller and weaker limb than in the male. There is only one seta on the ventral side of the second endopodite segment. The dorsal and middle setae of the terminal segment are about as long as the total length of the three distal segments; its ventral seta is subequal in length to the basal segment.

Caudal furca: the same as in male.

Remarks

Although this species is closely related to *Euconchoecia maimai* Tseng, 1969, from the Taiwan Straits, but it differs in many respects (Table 3)

Euconchoecia pacifica is also similar to *Euconchoecia* species 7, but is distinguishable from it on the basis of the length of the carapace and structure of the clasping organ on the right second antenna.

Distribution

This species inhabits in the subtropical waters of the Japan Sea (Chavtur, 1976; 1977) and the Pacific Ocean near Japan in the area bounded by 31°–40°N and 138°–152°E (Chavtur, 1977; 1991; 1992) generally in the

depth range 0–200 (500) m, but it was also caught in a tow from 1000 to 150 m.

Table 3. List of character distinguishing *Euconchoecia pacifica* Chavtur and *E. maimai* Tseng

Limb	Character	<i>Euconchoecia pacifica</i>	<i>Euconchoecia maimai</i>
Male:			
<i>First antenna</i>	a-seta	About 75% length of 2nd segment	About as long as 2nd endopodite
	b-seta	About 75% length of rod-sharped and shorter than sensory filaments	Subequal to length of rod-sharped organ and longer than sensory filaments
	d-seta	About 3½ times length of sensory filaments	About 2½ times length of sensory filaments
	e-seta	Slightly widened and flattened, about 1.5 times length of limb	Usual type, about 2 times length of limb
	Sensory filaments	23–25	22–23
<i>Second antenna</i>	Right clasping organ	Moderately slender	Very slender
	2nd endopodite segment	Terminally rounded (with sclerotized bulge)	Pointed (no such bulge)
<i>Mandible*</i>	Main terminal claw	About 75% or somewhat more than length of endopodite; 3-times length of 3rd endopodite segment	About 65% or somewhat less; twice as long
	2nd and 3rd endopodite segments	No ventral spines	Each with one stout spine
	2nd segment	Longest seta about 65–70% length of main claw-like seta	About 90%
	3rd segment	Most anterior seta about 70–75% length of main claw-like seta	About 80%
<i>Maxilla*</i>	1st endopodite segt	5 setae on anterior margin	4 setae
	2nd endopodite segt	Main claw twice length of segment	1½ times its length
<i>Fifth limb*</i>	Basale	7 setae	6 setae
	Main claw	Somewhat longer than total length of 1st and 2nd endopodite segments	As long as length of 1st segment
	Exopodite	Extends beyond end of limb	Just reaches middle of 1st endopodite segment
<i>Sixth limb*</i>	Epipodial plate	16 plumose long setae and one usual short seta	15 plumose long setae and one usual short seta
	1st endopodite segment	Two setae	Three setae
	2nd endopodite segment	Three setae; dorsal seta subequal to length of segment	Two setae; dorsal seta about 2/3 length of segment
<i>Caudal furca*</i>	Claws	Slender	Thick
<i>Copulatory app.</i>	Ratio between length and furca	1.7:1	1.5:1
	Protuberance at the tip	Small	Large

* These limbs are not described for female of the *E. maimai*

2. *Euconchoecia maimai* Tseng, 1969

Euconchoecia maimai Tseng, 1969: 7–11, Fig. 2.

Not *Euconchoecia maimai* Tseng, 1969 *sensu* Chen, Lin, 1995: 50–51, Fig. 56.

Distribution

This species occurs in the shallow waters of the Taiwan Straits between 21–25°N and 117–120°E (Tseng, 1969; 1970a; 1970b; Hanai et al., 1980; Chen, 1982).

3. *Euconchoecia species 7*

Euconchoecia maimai Tseng, 1969 *sensu* Chen, Lin, 1995: 50–51, Fig. 56.

Remarks

This species is closely related to both *E. maimai* and *E. pacifica*, but is much smaller than both these species. In addition, it differs from *E. maimai* in a having thicker right clasper on the second antenna, and from *E. pacifica* in that it lacks the sclerotized protuberance on the distal endopodite segment on the right second antenna.

Distribution

This species has been collected in the China Seas (Chen and Lin, 1995).

4. *Euconchoecia chierchiae* Müller, 1890

Euconchoecia chierchiae Müller, 1890: 277–278, Taf. 28, Figs. 1–10; 1906: 128, Taf. 32, Fig. 8–17; Brady, 1902: 190, Pl. 24, Figs. 9–15; Skogsberg, 1920: 740–755, Figs. 148–151; Deevey, 1968: 116–118, Fig. 62; Poulsen, 1969a: 38–40, Figs. 12, 13.

Paraconchoecia oblonga Claus, 1890 *sensu* Cleve, 1900: 40.

Not *Euconchoecia chierchiae* Müller, 1890 *sensu* Tseng, 1969: 2–6, Fig. 1; 1980: 416–417, Fig. 9.

Distribution

Circumtropical - subtropical interzonal species (Vinogradov, 1968, pp. 50–52: interzonal species inhabited in shallow and deep zones). It widely inhabits mainly shallow waters, but also in the open ocean in the tropical and subtropical region of the all oceans. In the East Atlantic (dividing line between East and West Atlantic is arbitrarily considered to be along 30°W), it has been recorded from between 18°N and 5°S and 26°W–10°E at depths from the surface to 900m (but most abundantly at depths of 0–200 m) and in vertical tows from 2000–0 m (Brady, 1902; Vavra, 1906; Müller, 1906; 1912; Scott, 1912; Seguin, 1966; Poulsen, 1969a; 1969b; Bainbridge, 1972; Angel and Fasham, 1975; Moguilevsky and Angel, 1975). In the Western Atlantic and Gulf of Mexico, it has been recorded from 42°N to 43°S and 33° to 75°W from depths ranging from 0–1700 m, but mainly from 50–200 m (Müller, 1890; Cleve, 1900; Vavra, 1906; Scott, 1912; Müller, 1912; Skogsberg, 1920; Barney, 1921; Deevey, 1952; 1960; 1968; 1970; 1971; 1978; 1982; Deevey, Brooks, 1982; Darby, 1965; Hopkins, 1966; Poulsen, 1969a; Baker et al., 1977; Angel, 1979; Gonzales, Breman, 1982; Drapun, 1983; Falavigna, 1983; Graves, 2011).

In the Indian Ocean, its recorded range is 19°N to 34°S and 34° to 113°E from depths of 0 to 530m, but also in vertical tows from 1500–2500m (Müller, 1906; 1908; 1912; Cleve, 1904; 1905; Leveau, 1967; 1969;

Leveau, Szekiolda, 1968; Poulsen, 1969a; George, 1969; Motoda et al., 1972; Okera, 1974; George, Nair, 1980; Hanai et al., 1980). Cleve (1904) also reported at shallow depths in the Red Sea between 15–16°N and 41–42°E.

In the South-West Pacific, this species has been reported in the Australian coastal waters of the New South Wales (Broken Bay and Port Jackson) (Dakin and Colefax, 1940). It has also been caught in the China Seas (Chen and Lin, 1995) and near Taiwan between 21°–26°N and 120–124°E from depths of 0–300 m (Poulsen, 1969a; Hanai et al., 1980). Poulsen (1969a) reported it from the Eastern Pacific at 21°N–29°S and 124°–179°E at depths ranging from 0–150 m.

5. *Euconchoecia species 1*

Euconchoecia chierchiae Müller, 1890 *sensu* Tseng, 1969: 2–6, Fig. 1; 1980: 416–417, Fig. 9.

Remarks

This species is closely related to *E. chierchiae*, but differs in the following respects; postero-dorsal spine on the right valve of females is situated well below of the dorsal margin (c.f. at the margin in *E. chierchiae*), the first antenna of the male has 21–24 sensory filaments (c.f. 25–27 filaments), the base of the clasping organ on the right second is short and thick (c.f. elongate and narrow), the copulatory appendage is very broad (c.f. moderately broad), the furcal claws are slender (c.f. stout).

Distribution

This species has only been found only in the Taiwan Straits and in the coastal waters of Hong Kong at depths of 7–50 m (Tseng, 1969; 1980).

6. *Euconchoecia aculeata* (Scott, 1894)

Halocypris aculeata Scott, 1894: 142–143, Pl. 15, Figs. 5, 6, 33, 34, 38

Euconchoecia aculeata (Scott, 1894): Poulsen, 1969a: 41–42, Fig. 15.

Not Euconchoecia aculeata (Scott, 1894) *sensu* Müller, 1906: 129, Taf. 32, Fig. 18–20, 22, 23, 25, 26; Tseng, 1969: 18–22, Fig. 4; 1980: 418–422, Pl. 3.; Chen and Lin, 1995: 43, Fig. 52; Chen, Yin and Zhang, 1983: 129–130, Fig. 54.

Distribution

In the Atlantic Ocean, this species is only known from tropical shallow water at 0°12'S – 7°19'E (Scott, 1894) and 8°14'N–13°27'W (Poulsen, 1969a). In the Indian Ocean, it occurs in all shallow sea areas from the equator to its north boundary, including the Red Sea, Arabian Sea, Persian Gulf, Gulf of Aden and Oman Gulf at depth ranges of 0–200 m (Leveau and Szekiolda, 1968; Leveau, 1969; George, 1969; McKenzie et al., 1979; George and Nair, 1980). In the South Pacific, it has been caught off Australia in the coastal waters of New South Wales (Dakin and Colefax, 1940) and also from areas between 9–29°S and 124–156°E near the surface (Müller, 1906; Poulsen, 1969a; Hanai et al., 1980). In the North-East Pacific, *E. aculeata* was reported from the coastal waters near San Salvador (Hartmann, 1957) and in the region 7°55'N–79°02'W in the depth 50 m (Poulsen, with disto-ventral sclerotized bulge)

1969a). In the North-West Pacific, it has been taken only from the regions 4°08'N–123°08'E and 7°14'N–114°49'E at depth 25–75 m (Poulsen, 1969a; Hanai et al., 1980).

7. *Euconchoecia* species 3 (Figs. 6 and 7)

Euconchoecia aculeata (Scott, 1894) *sensu* Tseng, 1969: 18–22, Fig. 4; 1980: 418–422, Pl. 3; Chen, Lin, 1995: 43, Fig. 52.

Studied material: - Adult female, length 1.0 mm, station 58 of R/V "Cavalero", 1 September 1980, 34°29'N 140°45'E, depth 0–100 m, in Juday Plankton Net (S = 0.1 m²), appendages mounted on slide and valves in alcohol. Specimen N 2779 In collection of the Museum of Institute of Marine Biology, Vladivostok, Russia.

Description of adult female

Carapace (Fig. 6A–E). Length 1.0 mm (exclusive of the postero-dorsal spines); height is 43% of its length. It is moderately elongated, with maximum height just posterior to the midlength. The dorsal margin is almost straight, and postero-ventral margin is oblique. There is a postero-dorsal spine on each valve; the spine on the right valve is much the longer. The rostrum tapers to fine point. There are carapace glands opening symmetrically just ventral to postero-dorsal corner.

Frontal organ (Fig. 6F). It is somewhat thinner in its distal half. Its tip is rounded and projects well beyond the end of the first antenna.

First antenna (Fig. 6F). The 1st segment is of the usual type and lacks any disto-ventral process. The fifth segment bears about 20 sensory filaments, which are similar in length to the limb of the first antenna.

Second antenna (Fig. 6G–I). The exopodite is about 70% the length of the protopodite. The ratio between the length of the first exopodite segment and the combined lengths of the other segments and also between the length of the protopodite and the exopodite is about 1.5:1. The "a" and "b" bristles on the first endopodite segment are comparatively short, weak and bare. The "b" bristle is about twice the length of the first endopodite segment. The second endopodite segment is elongate, more than a third the length of the protopodite and about 3 times as long as the first segment.

Mandible (Fig. 7A, B). The epipodial appendage is moderately developed. On the ventral side of the first endopodite segment is only a single short seta. There are two setae on the second segment, the shorter of the two is half the length of the longer. The third segment appears to carry only 6 (?) terminal setae.

Fifth limb (Fig. 7C, D). The first endite of precoxale has 2 setae, of which proximal seta is a short with short hairs, the distal seta is plumose and about as long as breadth of the segment. The second endite bears two similar setae. The coxale carries seven setae, two of which are very short, 2 are of moderate length and remaining 3 (one of which is stout) are about as long as the long setae on the endites. The basale is divided ventrally by a suture, and bears only four ventral setae. The exopodite is represented by long seta with short, fine hairs. This seta is longer than the endopodite. The first segment of endopodite has two ventral and one dorsal seta. The main terminal claw is equal in length to the endopodite. The outside of the precoxale and coxale are covered with long hairs.

Sixth limb (Fig. 6J). The epipodial appendage has 12 long and one short seta. The protopodite carries two disto-ventral quite short, non-plumose setae. The basale segment bears 3 ventral and one lateral seta. The exopodite is represented by seta similar in length as basal setae. The first endopodite segment is bare. The second segment has one ventral seta and one relatively long dorsal seta. The dorsal and middle setae of the distal segment are subequal and about as long as total length of the 3 distal segments.

Others limbs were damaged.

Remarks

This species is closely related to *Euconchoecia aculeata*, *Euconchoecia* species 2, and *Euconchoecia* species 4. Some differences between this species and *E. aculeata* (characteristics for *E. aculeata* in brackets) are:- 1) the frontal organ extends beyond the end of the first antenna (much shorter), and 2) the distal angle of

the right clasping organ with a protuberant process (Tseng, 1969)(lacks any such protuberance).

This species differs from *E. species 2* in the following characteristics: -

1) The shapes of the proximal segment of the endopodite of the second antenna in females and the right clasping organ in males.

2) The proportion between the length of the first endopodite segment and the protopodite of the second antenna in females is larger in *Euconchoecia species 3*, than that in *Euconchoecia species 2*

3) In *Euconchoecia species 3*, the tip of the frontal organ is rounded, whereas it is pointed in *Euconchoecia species 2*

4) In *Euconchoecia species 3*, the lengths of the sensory filaments on the male first antenna are only about double the height of its limb, but are over three times as long in *E. species 2*

It differs from *E. species 4* in its small size and sensory filaments of the first antenna being short relative to the height of the limb.

Distribution

It is known from the shallow waters near the Taiwan Island (Tseng, 1969; 1980; Chen, Lin, 1995), near Japan (34°N, 140°E) at 0–100 m (herein). Specimens of *Euconchoecia aculeata* reported from this region by Poulsen (1969a), Chen (1978, 1982) and Hanai et al. (1980) may also have also belonged to *Euconchoecia species 3*.

8. *Euconchoecia species 4*

Euconchoecia aculeata (Scott, 1894) *sensu* Chen, Yin, Zhang, 1983: 129–130, Fig. 54.

Remarks

This species is closely related to *Euconchoecia aculeata*, *E. species 2* and *E. species 3*, differing from all these species in its large size and relatively long sensory filaments of the first antenna relative to the height of the limb.

Distribution

This species has been found over the shelf the northern sector of the South China Sea and also between the islands of Paraselsky and Spratlee (Chen et al., 1983).

9. *Euconchoecia elongata* Müller, 1906, new status

Euconchoecia aculeata var. *elongata* Müller, 1906: 129, Taf. 32, Fig. 21.

Not *Euconchoecia elongata* Müller, 1906 *sensu* Tseng, 1969: 12–17, Fig. 3; Tseng, 1970b: 285, 286, 288, 289, 290, 293, 295; 1976: 201–212, Figs. 1–4; Tseng, 1980: 417–418, Fig. 10; Chen and Lin, 1995: 49–50, Fig. 55.

Distribution

This species has been described from the Indian Ocean (13°20'N, 46°41'E) in a vertical tow from 1200 m to surface (Müller, 1906). The specimens ascribed to *Euconchoecia* var. *elongata* by Poulsen (1969a); and by Hanai et al., (1980) from the Malayan Archipelago (one specimen 1.3 mm long; depth 50–75 m in 4°08'N, 123°00'E); and by Motoda et al. (1972) from the area 10°–14°S and 105°–113°E (in the upper 200 m) may also belong to this species.

10. *Euconchoecia* species 5

Euconchoecia elongata Müller, 1906, *sensu* Tseng, 1969: 12–17, Fig. 3; 1980: 417–418, Fig. 10; Chen, Lin, 1995: 49–50, Fig. 55.

Remarks

This species differs from *E. elongata* in following respects (characters for *E. elongata* in brackets): the length of the shell in females is >1.5 mm (<1.4 mm), the posterodorsal spine on the right valve is situated below of the dorsal margin (spine in line with the dorsal margin), this spine is aligned either parallel to the dorsal margin or is slightly turned down (slightly turned up).

Distribution

This species has been collected in the coastal waters near the Taiwan Island (Tseng, 1969, and probably Tseng, 1970b; 1975; Chen, 1978; 1982; Poulsen, 1969a; Hanai et al., 1980; ascribed by all these authors to *E. elongata*). The specimens reported as *E. elongata* from shallow water near the Island Guam at 13°30'N; 114°40'E (Tseng, 1976), the specimens 1.5–1.8 mm in length reported from the vicinity of the Malayan Archipelago at 4°08'N; 123°00'E (Poulsen, 1969a; Hanai et al., 1980) and off New South Wales, Australia (Daking and Colefax, 1940) probably also belong to *Euconchoecia* species 5.

11. *Euconchoecia shenghwai* Tseng, 1969

Euconchoecia shenghwai Tseng, 1969: 23–25, Fig. 5; Chen and Lin, 1995: 51, Fig. 57.

Distribution

This species was described from the upper 50 m of the shallow waters of the Taiwan Straits (24°25'N; 120°36'E and 25°30'N; 120°30'E) (Tseng, 1969; Hanai et al., 1980), and also from the China Seas (Chen and Lin, 1995).

12. *Euconchoecia bifurcata* Chen and Lin, 1984

Euconchoecia bifurcata Chen and Lin, 1984: 859–861, Fig. 1; 1985: 131–133, Fig. 1; Chen and Lin, 1995: 47–48, Fig. 53.

Distribution

This species has been taken in the East China Sea (28°–29°N and 124°–125°E) in the shallow (?) waters (Chen and Lin, 1984; 1985; 1995).

13. *Euconchoecia pax* Kornicker, 1989, new status

Euconchoecia bifurcata pax Kornicker, Iliffe, 1989: 29–43, Figs. 16–22, Tables 6, 7.

Remarks

Kornicker's specimens originally described as a subspecies are elevated to full species status because of some sharp differences from the Tseng's specimens. In *Euconchoecia pax*, the length is considerably smaller; the male frontal organ is flattened and pointed at the tip (bifurcate in *E. bifurcata*); female frontal organ extends well beyond the tip of the first antenna (barely reaches the end in *E. bifurcata*); in the male first

antenna has 18 sensory filaments (25 in *E. bifurcata*); the right clasping organ on the second antenna of the male is shorter and less elongated than in *E. bifurcata*; the caudal furca carries seven pairs of claws (8 pairs in *E. bifurcata*).

Distribution

This cave-dwelling species is known only from Palau, Koror (Oreor) Island, Ngermeuangel, Like 2A Cave (about 7°30'N, 134°30'E, ca. 800 km east of the Philippine Island of Mindanao) in the depth 8–36 m (Kornicker and Iliffe, 1989).

14. *Euconchoecia* species 6 (Figs. 8 and 9)

Material studied: Adult female N2777 (length 1.40 m), R/V "Cavalerovo" station 30, 39°00'N, 149°00'E, depth 0–100 m, August 23, 1980; adult female N2778 (length 1.40 mm), R/V "Cavalerovo" station 54, 36°20'N, 142°30'E, depth 0–100 m, August 30, 1980; collected in a Juday Plankton Net (S=0.1 m²), appendages mounted on slides and valves in alcohol. In collection of the Museum of Institute of Marine Biology, Vladivostok, Russia.

Description of adult female

Carapace: (Fig. 8A–I). The length 1.40 mm (exclusive of postero-dorsal spine); height 29% of its length. The carapace is very elongated, with its maximum height at midlength. In lateral view the dorsal margin is straight and the ventral margin is convex. Both carapace valves with a postero-dorsal spine, the spine on the right valve is considerably longer. Carapace glands open symmetrically just ventral to postero-dorsal corner. The postero-ventral margin is oblique.

Frontal organ: (Fig. 8J–L and 9A) is very slender in its distal half and just extends beyond the end of the 1st antenna. Its tip is bifurcate.

First antenna: (Fig. 8L and 9A). The 1st segment is usual type. The limb bears 20–21 sensory filaments, which are about 1.2 times the length of the limb. The second segment is a little shorter than third.

Second antenna: (Fig. 9B, C). The short seta on the first endopodite segment is shorter than the second segment. The seta of the third segment is about as long as the first segment.

Mandible: (Fig. 9D, E). The exopodite is represented by one long plumose seta, which is somewhat longer than the first endopodite segment. The ventral side of the first endopodite segment bears two setae. The short dorsal seta on the second segment does not extend as far as the end of the limb. The third segment is slim.

Fifth limb: (Fig. 9F). The basale segment bears four usual short ventral setae with short hairs and one long plumose lateral seta. The exopodite is represented by very long short-haired seta. This seta is subequal to total the basale and endopodite. The first endopodite segment has two ventral and one dorsal short setae, and second segment has the three terminal setae, which typical for genus.

Sixth limb: (Fig. 9G). The basale segment has four ventral and one lateral setae. The seta of exopodite is about as long as or slightly longer than the following segment. The first endopodite segment has one ventral seta and the second segment has one ventral seta and one dorsal seta. The dorsal and middle setae of the terminal segment are subequal; the third (ventral) seta is a little less than half the length of these other setae.

Remarks

This species is closely related to *E. bifurcata*, but differs by sized of the carapace, its posterior–dorsal spine placed on right valve and frontal organ, and number of sensory filaments on the first antenna.

Key to the 14 species of genus *Euconchoecia*

Now, 21 species of the genus *Euconchoecia* are known (Table 1). Below is given provisional keys only for species from the North-Western Pacific.

Key to Males

- 1a. Postero-dorsal corners of both valves are evenly rounded and lack spines..... 2.
- 1b. Postero-dorsal corner of one or both valves is armed with spine (the right valve of *E. aspicula* lacks a spine but is angled)..... 4.
- 2a. Length of carapace < 1.2 mm..... *Euconchoecia* species 7
- 2b. Length of carapace \geq 1.5 mm..... 3.
- 3a. Second segment of endopodite on right second antenna with large sclerotized disto-dorsal protuberance; claws of caudal furca are slim, second claw is c.60% length of first..... *E. pacifica*
- 3b. Second segment of endopodite on right second antenna lacks a large sclerotized disto-dorsal protuberance; claws of caudal furca are stout, second claw is c. 85% length of first..... *E. maimai*
- 4a. Tip of frontal organ is bifurcate..... *E. bifurcata*
- 4b. Tip of frontal organ is non-bifurcated..... 5.
- 5a. Only postero-dorsal corner of right carapace valve armed with a spine..... 6.
- 5b. Postero-dorsal corners of both carapace valves armed with a spine..... 7.
- 6a. Frontal organ extends well beyond end of first antenna; each first antenna carries 28–29 sensory filaments..... *E. shenghwai*
- 6b. Frontal organ shorter than first antenna; each first antenna carries 21–24 sensory filaments.... *E. chierchiaie*
- 7a. Height of carapace > 40% of its length of it..... 8.
- 7b. Height of carapace < 40% of its length..... *Euconchoecia* species 5
- 8a. Length of carapace > 1.5 mm..... *Euconchoecia* species 4
- 8b. Length of carapace < 1.4 mm..... 9.
- 9a. Frontal organ much shorter than first antenna..... 10.
- 9b. Frontal organ equal to or longer than first antenna..... 11.
- 10a. Maximum carapace height anterior to midline; base of clasper of right second antenna thick, considerably thicker than its distal part..... *Euconchoecia* species 1
- 10b. Maximum carapace height at midlength; both basal and distal sections of clasper on right second antenna thin and of similar thickness..... *E. aculeata*
- 11a. Frontal organ flattened distally and extending well beyond down-curved distal segments of first antenna (cave-dwelling species) *E. pax*
- 11b. Frontal organ unflattened, barely extending beyond down curving distal segments of first antenna.....12.

- 12a. Maximum carapace height less than half its length, knee of right clasper of second antenna with a process *Euconchoecia* species 3
 12b Maximum carapace height equal to half its length, knee of right clasper of second antenna lacks a process *Euconchoecia* species 2

Key to Females

- 1a. Height of carapace \geq 50% length, postero-dorsal corners of both carapace valves evenly rounded..... 2
 1b. Height of carapace < 50% length, postero-dorsal corner of at least one valve armed with spine (the right valve of *E. aspicula* lacks a spine but is angled)..... 4.
- 2a. Carapace length < 1.3 mm..... *Euconchoecia* species 7
 2b. Carapace length > 1.4 mm..... 3.
- 3a. Furcal claws are slim, length of second claw ca. 60% of first..... *E. pacifica*
 3b. Furcal claws are stout, length of second claw ca. 85% of first..... *E. maimai*
- 4a. Tip of frontal organ is armed with 2 terminal spines..... 5.
 4b. Tip of frontal organ is either rounded or pointed 7.
- 5a. Frontal organ extends well beyond end of first antenna (cave dwelling species) *E. pax*
 5b. Frontal organ is similar in length to the first antenna..... 6.
- 6a. Carapace length < 1.5 mm, breadth of first antenna is ca.30% of its length, and it bears 20-21 sensory filaments..... *Euconchoecia* species 6
 6b. Carapace length > 1.7 mm, breadth of first antenna is ca.15-20% of its length and bears 25 sensory filaments..... *E. bifurcata*
- 7a. Carapace height ca. 40-50% of its length..... 8.
 7b. Carapace height ca. 30% of its length..... 15.
- 8a. Postero-dorsal corner of right carapace valve only with spine..... 9.
 8b. Postero-dorsal corners of both carapace valves carry a spine..... 10.
- 9a. Rostrum of both right and left valves of similar length; first 1st antenna with 28-29 sensory filaments *E. shenghwai*
 9b. Rostrum on left carapace valve is much longer than on right valve, first antenna with 21-23 sensory filaments..... *E. chierchiaie*
- 10a. Length of carapace >1.5 mm..... *Euconchoecia* species 4
 10b. Length of carapace <1.3 mm.....11.
- 11a. Frontal organ shorter than limb of first antenna.....12.
 11b. Frontal organ far longer than limb of first antenna.....13.
- 12a. Postero-dorsal spine of right valve is placed below of its dorsal margin..... *Euconchoecia* species 1
 12b. Postero-dorsal spine and dorsal margin of right valve form one straight line..... *E. aculeata*

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- 13a. Rostrum on right and left valves is approximately equal in length, postero-dorsal spine on right valve is placed below its dorsal margin..... *Euconchoecia* species 3
- 13b. Rostrum on left valve is considerably longer than on right valve, postero-dorsal spine and dorsal margin of right valve form one straight line..... 14.
- 14a. Length of shell <1.4 mm, postero-dorsal spine and dorsal margin of right valve aligned.....*E. elongata*
- 14b. Length of shell >1.5 mm, postero-dorsal spine on right valve below of dorsal margin.....
..... *Euconchoecia* species 5

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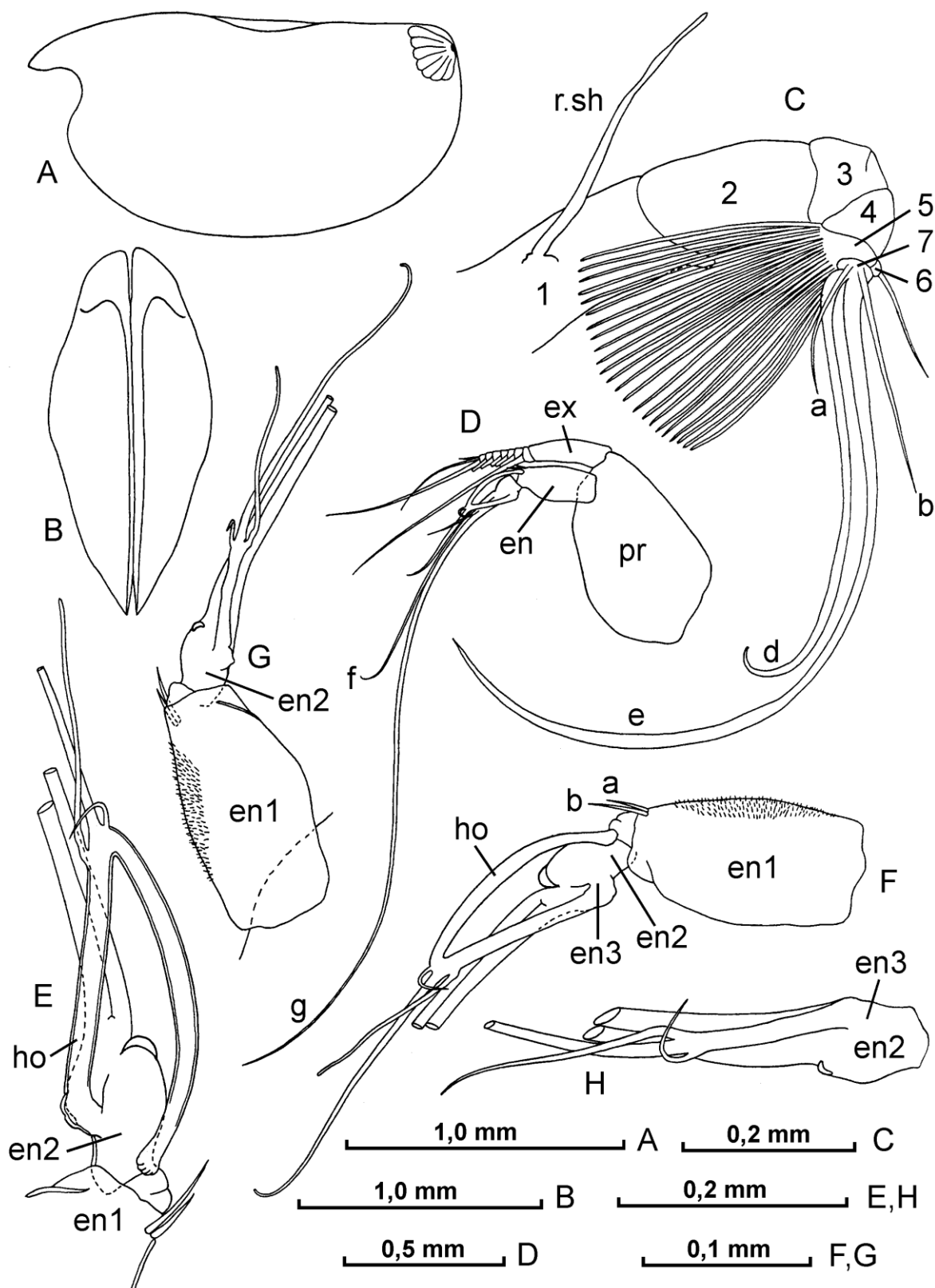


Figure 1. *Euconchoecia pacifica* (male: A–F, H - N2773 and G - N2774). A - left valve of shell, B - shell in ventral view, C - frontal organ and first antenna, D - second antenna, E and F - right endopodite of second antenna, G and H - left endopodite of second antenna.

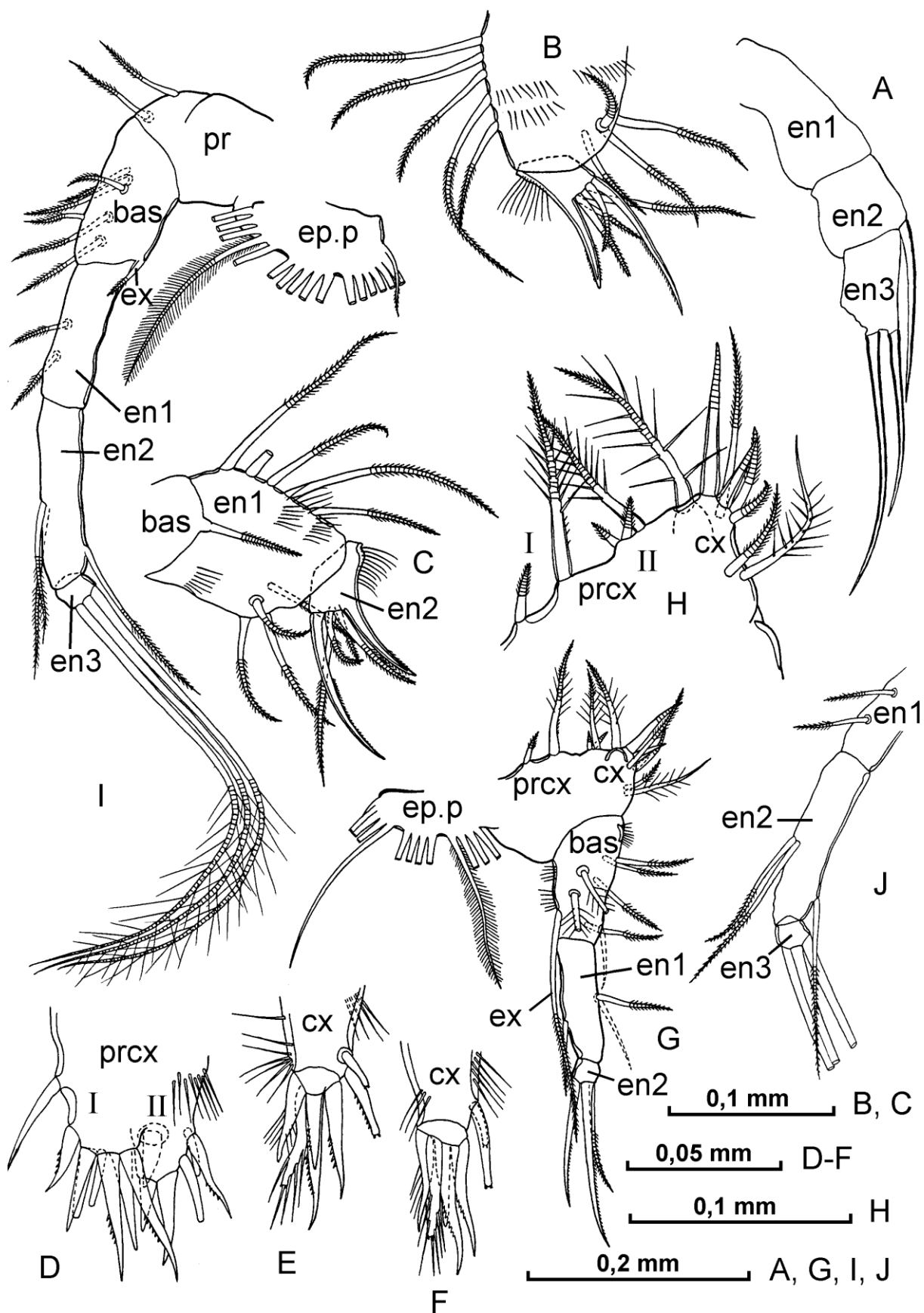


Figure 2. *Euconchoecia pacifica* (male - N2774). A - endopodite of mandible, B and C - maxilla, D-F - precoxal and coxal endites of maxilla, G and H - fifth limb and its proximal part, I and J - sixth limb and its distal part.

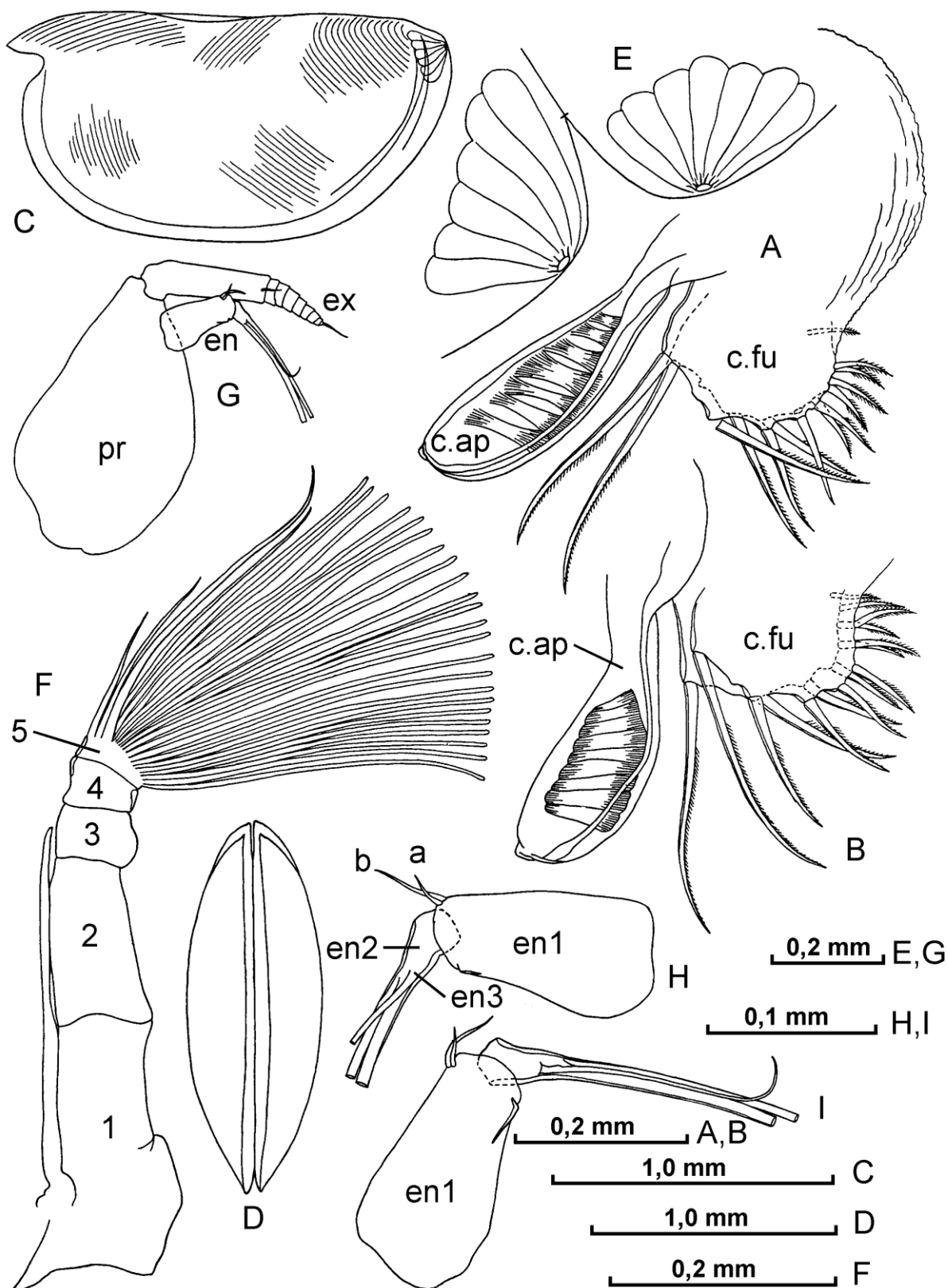


Figure 3. *Euconchoecia pacifica* (male: A - N2774 and B - N2773; female: C-F - N2772 and G-I - N2776) A and B - copulatory appendage and caudal furca, C - left valve of shell, D - shell in ventral view, E - postero-dorsal angles of shell, F - frontal organ and first antenna, G - second antenna, H and I - endopodite of second antenna.

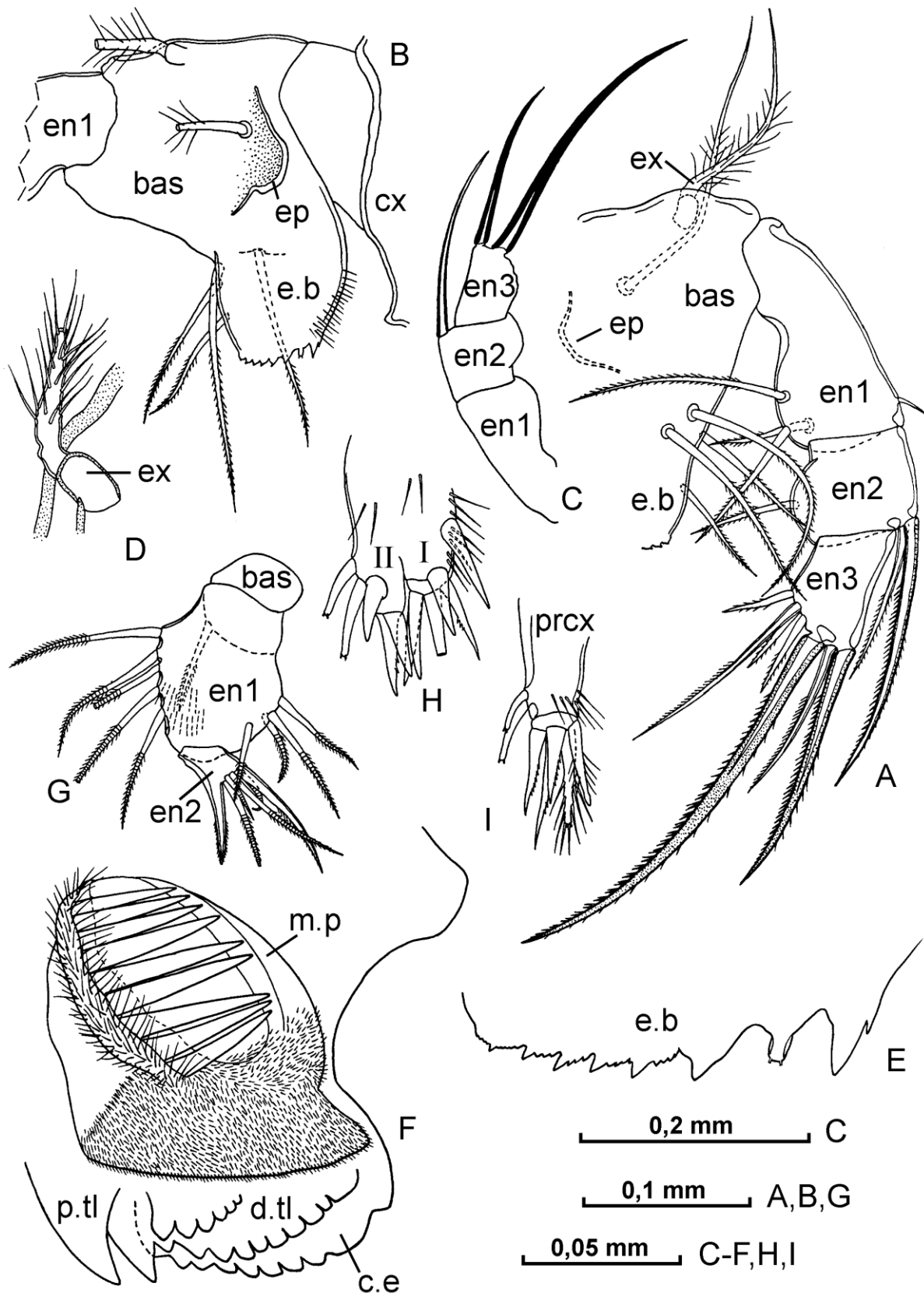


Figure 4. *Euconchoecia pacifica* (female: A, C, G-I - N2776 and B, D-F - N2772). A - mandible, B - basale and exopodite of mandible, C and D - endopodite and exopodite of mandible, E - basal endite of mandible, F - tooth edge, distal and proximal tooth rows and masticatory pad on coxale of mandible, G - maxilla, H and I - precoxal and coxal endites of maxilla.

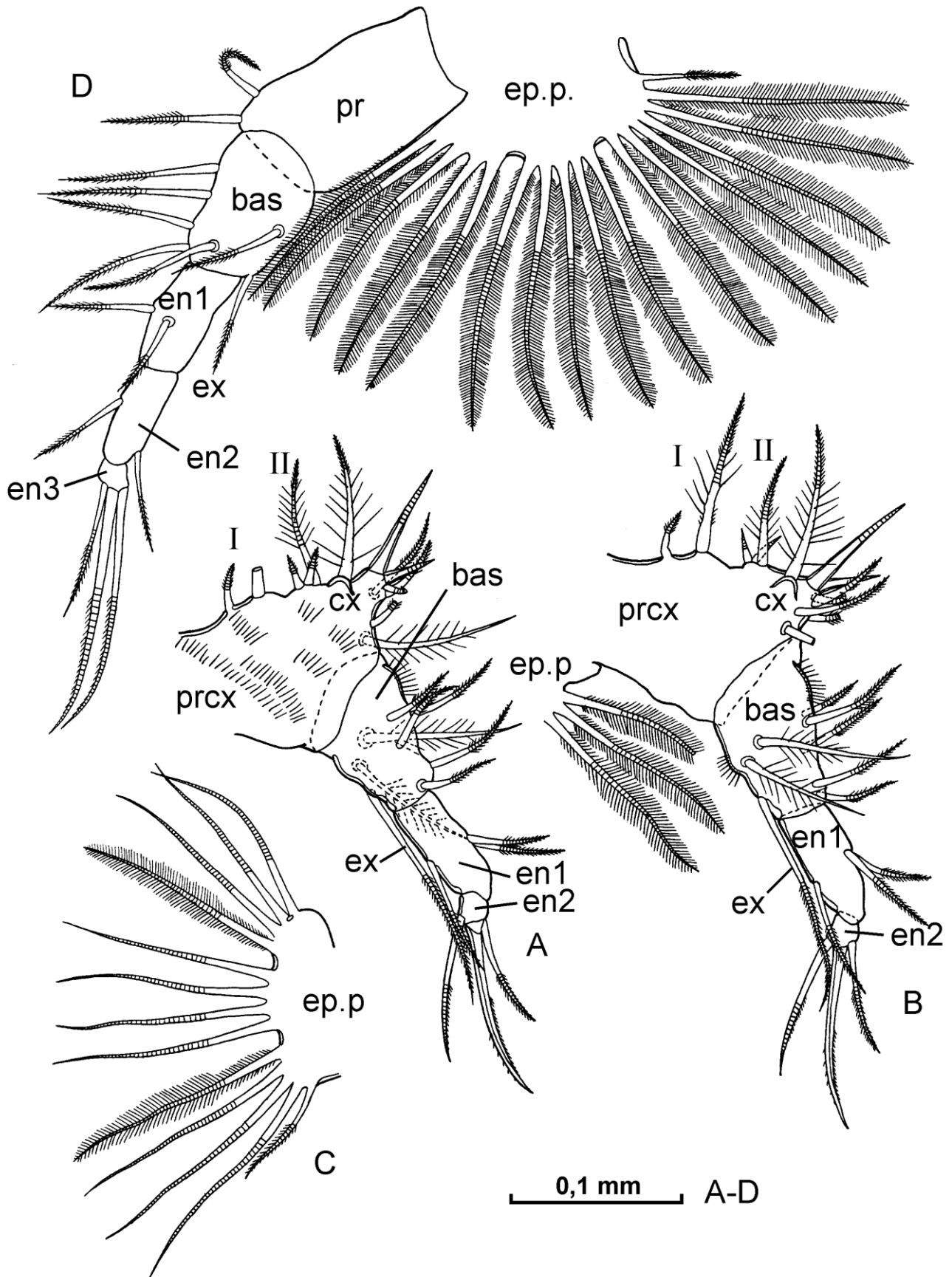


Figure 5. *Euconchoecia pacifica* (female- N2776) A and B - fifth limb, C - epipodite of 5th limb, D - sixth limb.

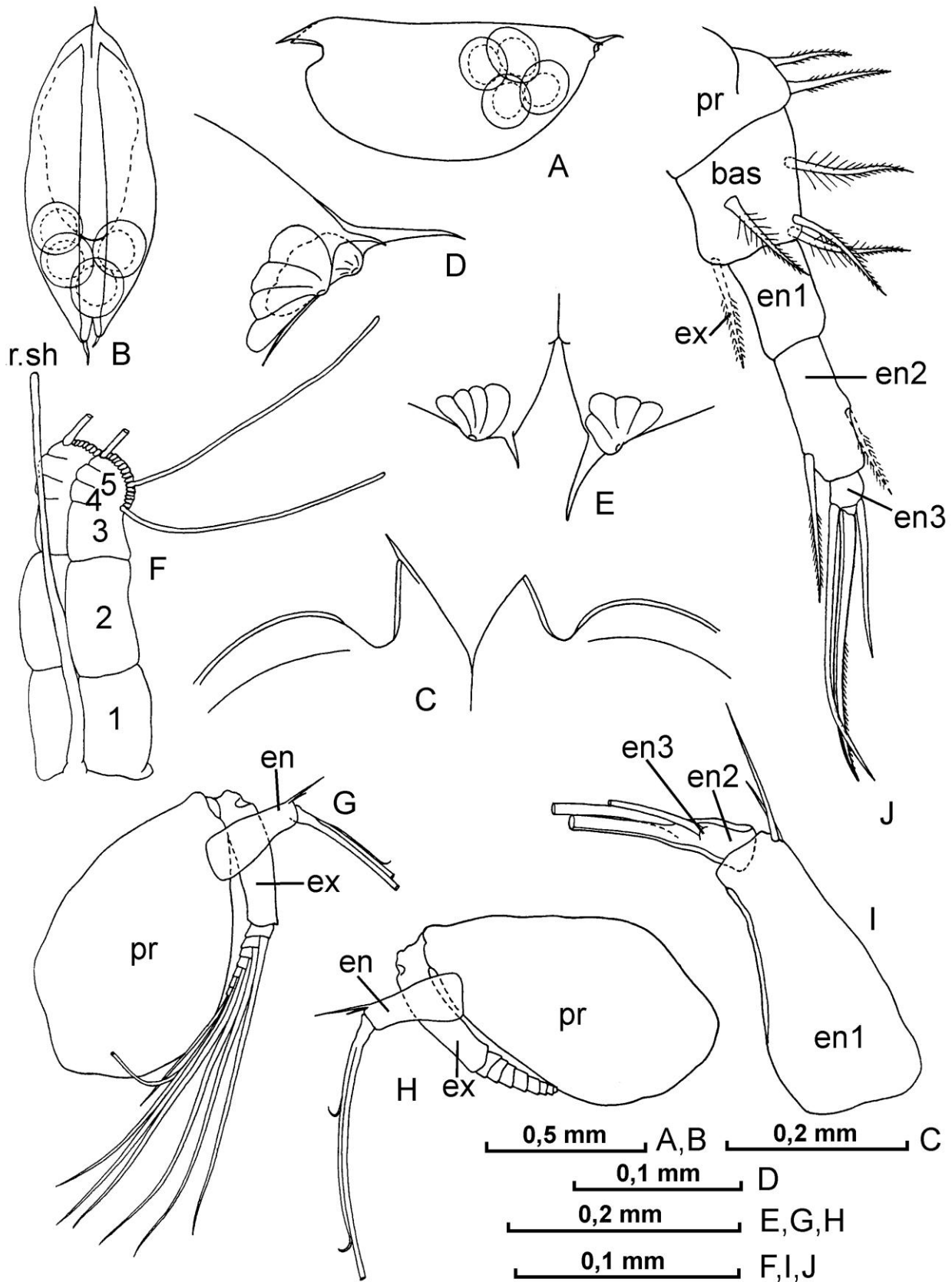


Figure 6. *Euconchoecia* species 3 (female - N2779) A - left valve of shell, B - shell in ventral view, C - antero-dorsal part of shell in ventral view, D and E - postero-dorsal part of shell in lateral and ventral views, F - frontal organ and first antenna, G and H - second antenna, I - endopodite of second antenna, J - sixth limb.

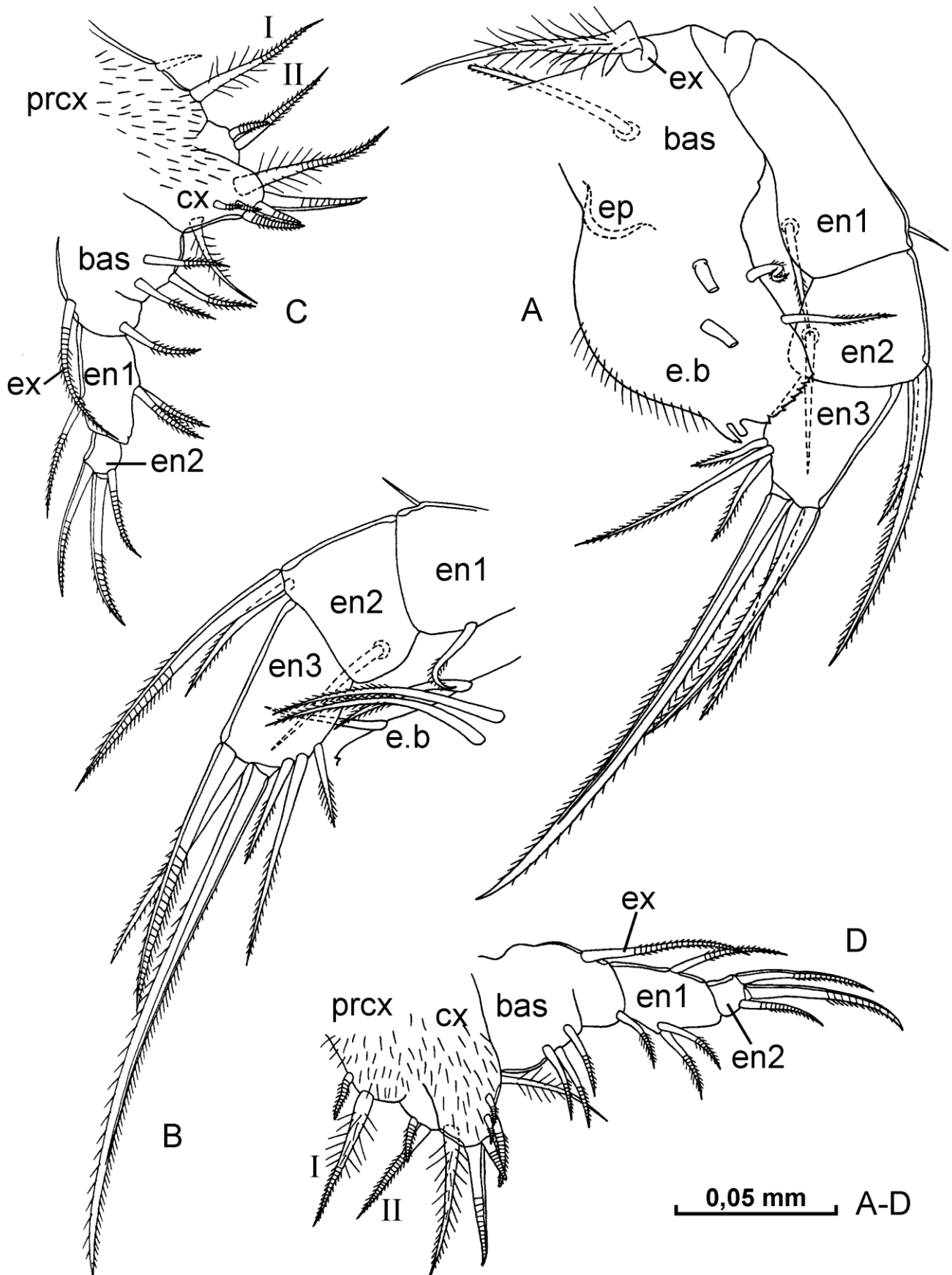


Figure 7. *Euconchoecia* species 3 (female - N2779) A and B - mandible, C and D - fifth limb.

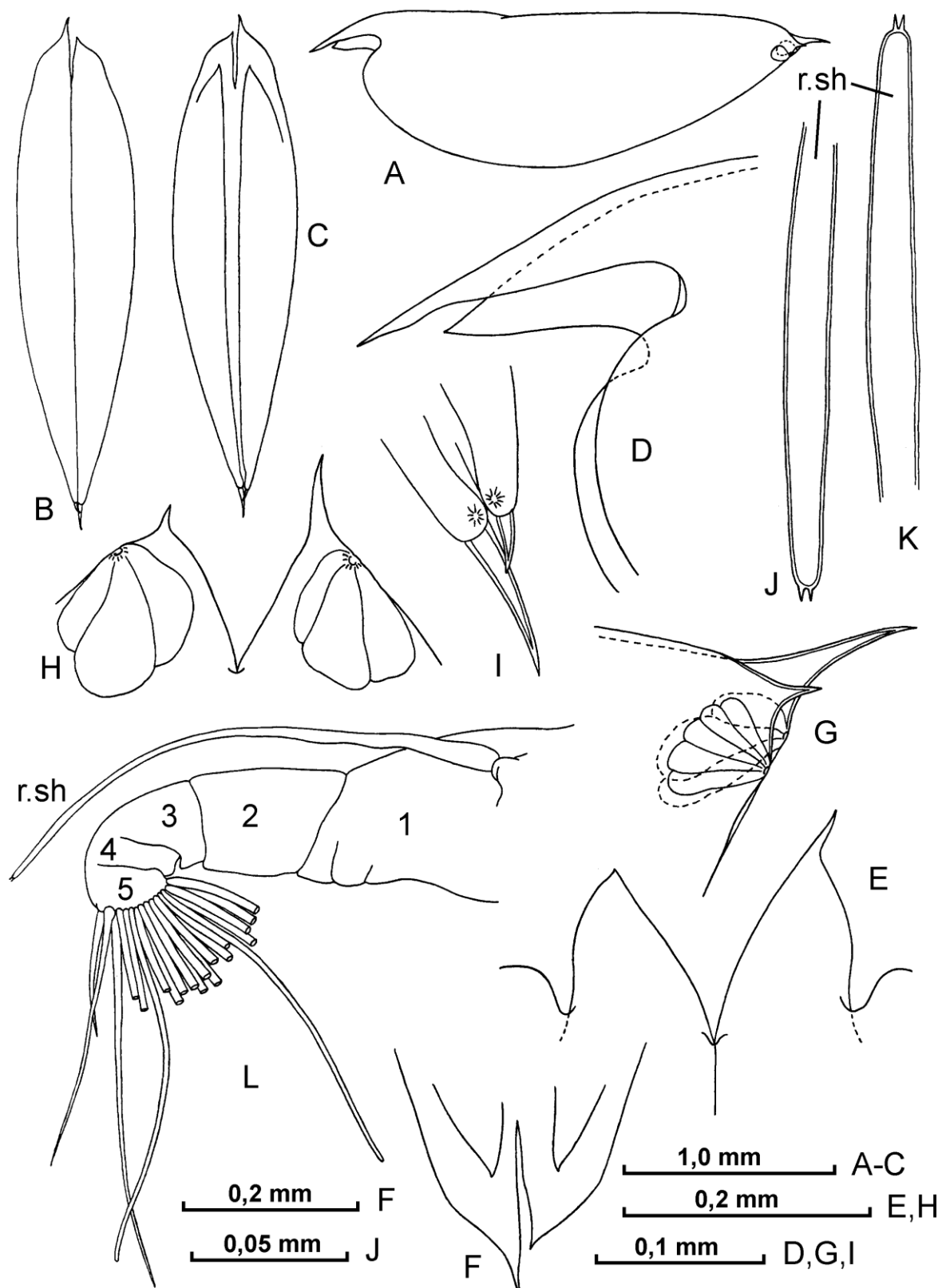


Figure 8. *Euconchoecia* species 6 (female: A–I, K - N2777 and J, L - N2778) A, B and C - shell in lateral, dorsal and ventral views, D - rostrum of shell in lateral view, E and F - rostrum in ventral view, G – postero-dorsal part of shell in lateral view, H and I – postero-dorsal part in ventral view, J and K - distal part of frontal organ, L - frontal organ and first antenna.

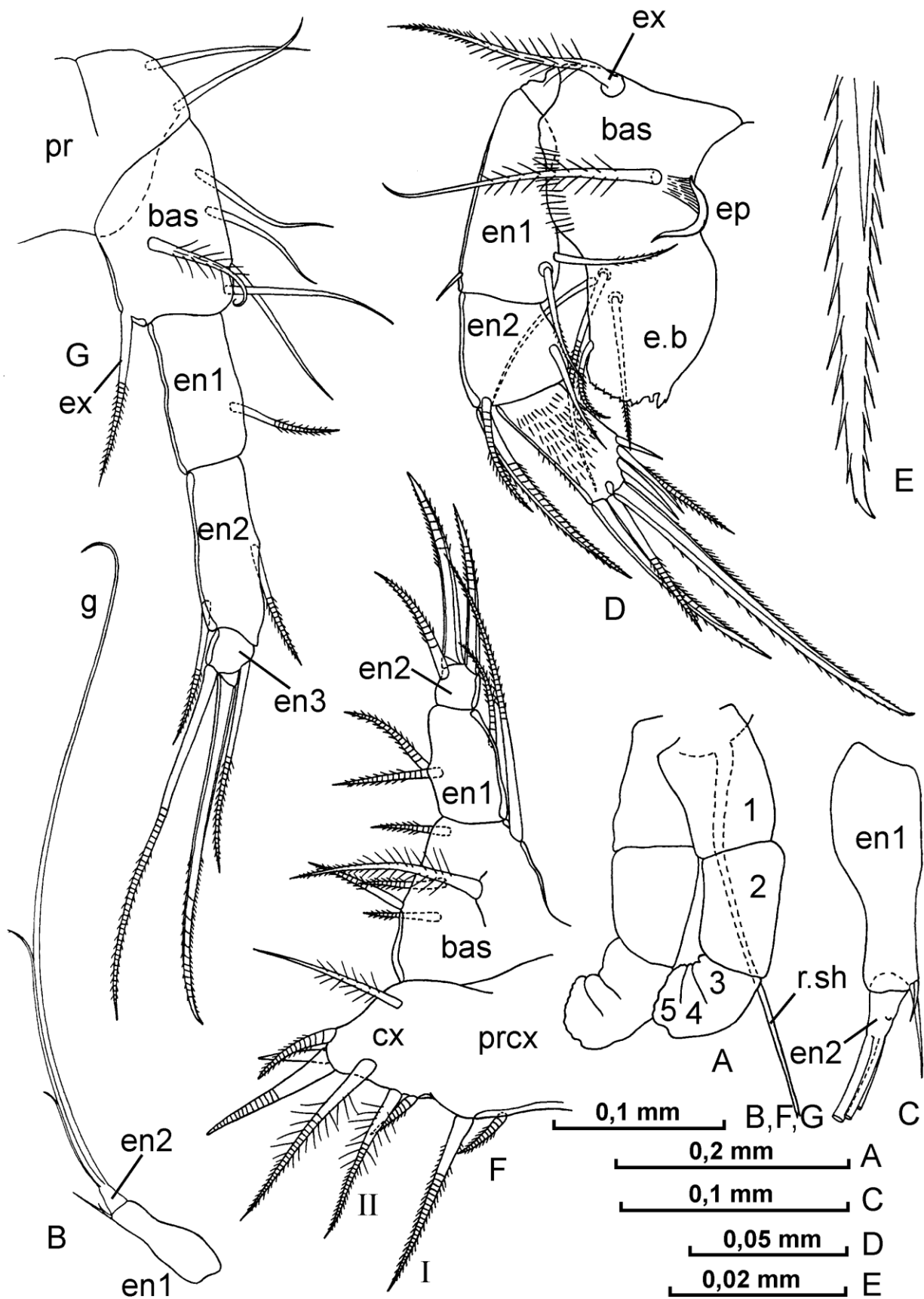


Figure 9. *Euconchoecia* species 6 (female: A - N2778 and B-G - N2777). A - frontal organ and first antenna, B and C - endopodite of second antenna; D - mandible, E - distal part of main claw on mandible, F - fifth limb, G - sixth limb.